

METHOD AND SYSTEM FOR USING ONE FORM TO SEND A MESSAGE
USING MULTIPLE TRANSPORTS

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Field of the Invention

The present invention relates generally to computer-executable software, and more particularly to sending a message using multiple transports.

Background

As processors have become smaller, they have proliferated and spread.

- 10 Consumer electronics of almost any size now include controllers or processors and perform many functions that used to be the domain of desktop computers. One such device, the cellular phone, once dedicated to transmitting voice communication is now being used to transmit in addition to voice communication a variety of other data. Some cellular phones allow users to connect to the Internet and browse web sites; other
- 15 cellular phones allow users to check and send email.

- In this increasingly connected world, options for sending messages are also increasing. Some people may be reached through paging, voice mail, email, and other wireless communication devices; others prefer providing only an email address. Some people are on-call 24 hours a day; others prefer to receive messages from 9 to 5.
- 20 With all the communication options available, it is becoming more of a challenge to send a message through the appropriate transport when multiple recipients are involved. For example, a user may be required to use one system to send the message to recipients through a pager transport, another system to send the message to recipients through a voice mail transport, and yet another system to deliver the message to recipients through
- 25 an email transport. Alternatively, a user may use one device to send the message to pager, voice mail, and email recipients but may be required to manually group recipients of each type together and use different options on the device to send the message to each group through the appropriate transport.

Summary

The present invention provides a method and system for sending a message to multiple recipients using multiple transports from the same user interface. The invention provides a common interface for addressing a message to an email
5 recipient and/or a wireless communication recipient, such as a cellular phone or pager user. Furthermore, the invention provides a method for determining if the message should be transmitted through multiple transports and if so, indicating to the multiple transports that the message is ready to be transmitted.

In one aspect of the invention, the user is provided a form for sending
10 messages. The user may select recipient(s) address(es) using a contact list, or the user may directly enter the address. Using the address entered and/or contact information, the appropriate transport is selected. For example, the user might enter an address of JaneDoe@microsoft.com (email address) or +14252332333 (SMS address). Based on the format of the data entered, the invention determines the appropriate transport(s) and
15 flags the message accordingly.

In another aspect of the invention, each transport uses the flags to determine if it should deliver the message to one or more recipients. When a transport determines that it should deliver the message, it does so and marks that the message has been delivered by clearing its respective flag. When all the flags associated with the
20 message have been cleared, the message may be moved to another folder, such as a sent items or a deleted items folder, or appropriately processed.

The invention simplifies sending messages. Instead of requiring a user to use one device to send the message to email recipients and another device to send the message to wireless recipients, or alternatively one form or submenu to send the
25 message to email recipients and another form or submenu to send the message to wireless recipients, the user may use one device and one form to send the message to recipients using multiple transports.

Brief Description of the Drawings

FIGURE 1 is a functional block diagram showing an exemplary system in which the invention operates;

FIGURE 2 is a functional block diagram illustrating a messaging system adapted to accept inputted addresses and route them to an appropriate transport;

FIGURE 3 shows two input components, one blank and one filled in, for sending a message to one or more recipients;

FIGURE 4 is a logical flow diagram illustrating a process for determining and flagging which transports to use when sending a message to one or more recipients;

FIGURE 5 is a logical flow diagram illustrating a process for determining if a transport has one or more recipients to deliver a message to and sending the message if so determined;

FIGURE 6 is a functional block diagram illustrating functional components of a mobile computing device 600; and

FIGURE 7 is a functional block diagram illustrating an exemplary system for implementing the invention in accordance with the invention.

Detailed Description

The present invention provides a method and system for sending a message to recipients using one or more transports. Among other things, disclosed is a method for determining which transport should transmit a message to a recipient and for flagging the message appropriately. Also disclosed is a method a transport may employ to use the flagged messages to determine if the transport has a message to deliver and if the transport is the last transport delivering the message. When the latter condition occurs, the transport may move the message to another folder, such as a sent items or a deleted items folder, or take other appropriate action. First, an illustrative operating environment, computing device, and mobile device will be described. Then an illustrative message delivery system will be discussed together with a method the

message delivery system may use to deliver messages recipients using multiple transports.

Illustrative Operating Environment

5 With reference to FIGURE 1, an exemplary system in which the invention operates includes mobile devices 105-107, computers 110-112, cellular/pager network 115, gateway 120, and wide area network (WAN)/local area network (LAN) 125. Mobile devices 105-107 and computer 111 include messaging system 200 which is described in more detail in conjunction with FIGURE 2.

10 Mobile devices 105-107 are connected to cellular/pager network 115. Mobile devices 106 and 107 may also be connected directly to WAN/LAN 125. For example, mobile devices 106 and 107 may have a network interface that allows them to plug directly into WAN/LAN 125. Mobile devices 106 and 107 may have a radio frequency (RF) connection in communication with a router or gateway that is part of
15 WAN/LAN 125. Alternatively, mobile devices 106 and 107 may send all communications to WAN/LAN 125 through cellular/pager network 115, addressing the messages such that they travel across gateway 120.

 Computers 110-112 are connected to WAN/LAN 125, while computer 111 is also connected directly to cellular/pager network 115. Computer 111 may have a
20 cellular/pager communication device which allows it to send messages directly to cellular/pager network 115 (instead of routing such messages through gateway 120). Alternatively, computer 111 may send all communications to cellular/pager network 115 through WAN/LAN 125, addressing the messages such that they travel across gateway 120.

25 Generally, mobile devices 105-107 are any movable devices capable of executing software and sending information to or receiving information from cellular and/or pager networks and/or a WAN/LAN. Such devices include personal computers, hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, wearable computers, and the like. Hand-held
30 devices include cellular phones, smart phones, pagers, POCKET PCs, personal digital

assistants (PDAs), integrated devices combining one or more of the preceding devices, and the like. An exemplary mobile device is shown in FIGURE 6 and described in conjunction therewith.

Generally, computers 110-112 are any devices capable of sending
5 information to and receiving information from a WAN/LAN. Typically, computers 110-112 include less movable computing devices such as minicomputers, mainframes, and the like in addition to the devices described in conjunction with mobile devices 105-107. An example of a computer is shown in FIGURE 7 and described in conjunction therewith.

10 Cellular/pager network 115 is a network delivering messages to and receiving messages from devices capable of wireless communication. Cellular/pager network 115 may include both wireless and wired components. For example, cellular/pager network may include a cellular tower that is linked to a wired telephone network. Typically, the cellular tower carries communication to and from cell phones
15 and pagers, and the wired telephone network carries communication to regular phones, long-distance communication links, and the like. One example of a messaging service that would use cellular/pager network 115 is the Simple Messaging Service (SMS) system which delivers short text messages to devices receiving pager communication.

Cellular/pager network 115 is coupled to WAN/LAN through gateway
20 120. Gateway 120 routes messages between cellular/pager network 115 and WAN/LAN 125. For example, a computer user may send an email that is addressed to a pager. Gateway 120 provides a means for transporting the email from WAN/LAN 125 to cellular/pager network 115. Conversely, a user with a device connected to a cellular network may be browsing the Web. Gateway 120 allows hyperlink text
25 protocol (HTTP) messages to be transferred between WAN/LAN 125 and cellular/pager network 115.

Typically, WAN/LAN 125 transmits information between computing devices. One example of a WAN is the Internet which connects millions of computers over a host of gateways, routers, switches, hubs, and the like. An example of a LAN is

a network used to connect computers in a single office. A WAN may connect multiple LANs.

Illustrative Message Routing System

5 FIGURE 2 is a functional block diagram illustrating a messaging system adapted to accept inputted addresses and route them to an appropriate transport, according to one embodiment of the invention. Messaging system 200 includes input component 305, address processor 210, message store 215, and transports 220, 225, and 230. Although only three transports are shown, it will be understood that more
10 transports could be added or transports could be removed without departing from the spirit and scope of the invention.

 Input component 305 is described in more detail in conjunction with FIGURE 3. Briefly, input component 305 receives a message and one or more addresses indicating where the message should be delivered. After receiving the
15 message, input component 305 receives user input indicating that the message should be sent.

 Address processor 210 processes the addresses received by input component 305 to determine which transports should be used to deliver the message. For example, an address may include only digits, such as 12063426253. Such an
20 address may be interpreted as a pager number indicating that the message associated with the address should be delivered over a pager network. Alternatively, an address may include digits and dashes, such as 1-206-342-6253, parenthesis, spaces, digits, and dashes, such as (206) 342-6253, periods, such as 1.206.342.6253, a plus sign and digits, such as +12063426253, etc. Such addresses may also be interpreted as pager numbers
25 indicating that the message associated with the address should be delivered over a pager network. The address may contain a number, which, after searching a database, address processor 210 determines to be a number associated with a fax machine indicating that the message associated with the address should be delivered as a fax message over a cellular network. The address may contain an '@' symbol, such as

JaneDoe@microsoft.com, and be interpreted as an email indicating that the message should be delivered over a WAN/LAN.

Address processor 210 may be configured to search for various patterns in the address and to select a default format when address processor 210 cannot
5 recognize the pattern. For example, an address may include digits and letters, such as MailAddress123. Address processor 210 may be configured to mark such messages for delivery using a default transport protocol, such as the simple mail transport protocol (SMTP) for delivery over the Internet. After address processor 210 determines which transport should deliver the message to the address, address processor 210 stores the
10 message in message store 215, may set a flag indicating that a particular transport protocol has at least one recipient to deliver the message to, and then may add the recipient to a list of recipients to which the transport should deliver the message. When a transport, such as transport 220, requests a recipient to send the message to, message store 215 may deliver the next recipient on the list associated with the requesting
15 transport. After all the recipients on the list associated with the transport have been requested, when the transport, such as transport 220, requests another recipient to send the message to, message store 215 may indicate that no further recipients for messages to be delivered by the transport exist.

Input component 305 may receive multiple addresses for one message.
20 Address processor 210 continues determining which transport protocol should deliver the message to each of the addresses until all addresses have been processed. As it determines which transport should deliver the message to the recipient, address processor 210 continues to set a flag and add the recipient to a list to be delivered by the determined transport. After all addresses have been processed, address processor 210
25 notifies transports 220, 225, and 230 that the message is ready for delivery.

When a transport, such as transport 220, is notified that a message is ready for delivery, it first determines whether the message should be delivered using the transport. Typically, this is done by retrieving from message store 215, a flag previously set by address processor 210. Using the flag, the transport determines
30 whether it should deliver the message to any recipients. When the transport determines

that it should deliver the message to at least one recipient, it begins requesting recipients to deliver the message to. After each message is sent, the transport requests another recipient to send the message to until all recipients associated with the transport have been requested.

5 After the transport has requested and sent to all recipients associated with the transport, the transport requests that the flag indicating that the transport has recipients to deliver to be cleared and determines if it is the last transport sending the message. It may do this by checking if flags associated with other transports are still set. If no other flags are set, the transport may move the message to another folder,
10 such as a sent items or a deleted items folder, or take other appropriate action.

FIGURE 3 shows two input components, one blank and one filled in, for sending a message to one or more recipients, according to one embodiment of the invention. Input component 305 includes uncompleted To field 315, carbon copy (CC) field 320, subject field 325, and message field 330. In addition, input component 305
15 includes send option 335 and menu option 340. Completed form 310 is similar to input component 305, except that the To field, CC field, subject field, and message field have been provided with input. It will be recognized that other fields or options could be included without departing from the spirit and scope of the invention.

To fields 315 and 345 receive addresses of recipients. The address may
20 be literal, as in JaneDoe@microsoft.com, or it may proxy for such an addresses, such as “Neil Enns.” A proxy for an address occurs when, for example, a user selects a name from a contact list. Rather than displaying the literal address, i.e. NeilEnns@microsoft.com, the form may display the name of the person the message is directed at while internally indicating (and not displaying) that the message should be
25 sent to NeilEnns@microsoft.com or pager 14253323322 as the case may be. For example, when selecting a recipient from a contact list, a user may search for the contact and, after finding it, select an email address or pager number listed with the contact. With either selection, a name, such as Neil Enns, appears in To field 345, while internally, the recipient is associated with the complete literal address.

CC fields 320 and 350 operate similarly to To fields 315 and 345. Specifically, a user may enter either a literal address, such as JaneDoe@microsoft.com or select an address from a contact list. Then, either the literal address, or a proxy for the address, is displayed.

5 Subject fields 325 and 355 may contain any text that the user feels appropriate. Typically, a user enters the subject of the message, but the user may enter other information such as “Urgent!”, “Call me”, etc.

10 Message fields 330 and 360 typically contain the main body of the text the user desires to send to the recipients. When a user desires to send, in addition to text, non-textual information, such as a picture (not shown), the user may attach the information to the message. Such messages may be encoded using multi-part MIME (Multipurpose Internet Mail Extensions) or other encoding techniques.

15 Send options 335 and 365 allow the user to send a message. Typically, a user clicks or selects send option 365 after the user has completed filling in the fields on the form. For example, after entering the information on input component 310, the user sends the message using send option 365.

20 Menu options 340 and 370 may be used to bring up a menu of other functions, such as to enter contacts, select other features, or exit input component 310. For example, using menu 370, the user may retrieve a list of contacts, select to send the message to Neil Enns’ pager number, and/or specify options such as urgent delivery, etc. Such an action would then typically cause Neil Enns to be listed in To field 345.

25 FIGURE 4 is a logical flow diagram illustrating a process for determining and flagging which transports to use when sending a message to one or more recipients. The process begins at block 405 when a user opens a message form, such as input component 305 shown in FIGURE 3.

At block 410, the user enters information into the form. For example, referring to FIGURE 3, the user enters recipients in To field 315, CC recipients in CC field 320, a subject line in subject field 325, and a message in message field 330. A completed message may look like the one partially shown in input component 310.

When the user is finished composing the message, the user uses send option 365 to indicate that the message should be sent.

At block 415, a loop is entered which examines each address specified to determine which transport should be used to send the message to the recipient. As long as an address remains to be processed, processing branches through the yes branch to block 420. When all addresses are processed, processing branches through the no branch to block 435. For example, referring to FIGURE 3, three addresses are shown. More addresses may be contained in input component 310. Addresses both in To field 345 and CC field 350 are included when determining if more addresses remain to be processed.

At block 420, a determination is made as to whether the address is a short message service (SMS) address. An SMS address is typically used to indicate that the message should be delivered over a pager or cellular network. As indicated with reference to address processor 210, many different types of numerical configurations, including +12063426253, 1-206-342-6253, (206) 342-6253, 1.206.342.6253, etc. may be used to indicate an SMS address. Additionally, an SMS address may be represented explicitly (although not seen on input component 310) by the user specifying an SMS address from a contact list. When the address is not an SMS address, processing follows the yes branch to block 440. When the address is an SMS address, processing follows the no branch to block 425. For example, while processing "Neil Enns" in To field 345 of FIGURE 3, the no branch is followed to block 440 because "Neil Enns" was explicitly chosen from the contacts as an email address.

At block 425, a determination is made as to whether the message should be delivered by some other supported transport. For example, the address may indicate that the message should be delivered over a cellular network to a fax machine. If delivering messages to fax machine recipients is supported, the yes branch is followed to an appropriate flagging block, such as block 445; otherwise, the no branch is followed to block 430. For example, when evaluating the address JaneDoe@microsoft.com, the no branch is followed to block 430. It will be recognized

that block 425 may be expanded to included tests for various types of addresses such as fax, X.400, etc., without departing from the spirit and scope of the invention.

At block 430, a flag is set indicating that a message is addressed to an SMTP address or that an unknown address type was specified. In addition, the address
5 may also be placed in an SMTP list such that when an SMTP transport asks for the next address to deliver the message to, the address may be quickly retrieved and sent to the SMTP transport. For example, referring to FIGURE 2, address processor 210 determines that the message is addressed to an SMTP recipient (or that the message is addressed to be delivered through an unknown transport) and sets a flag indicating that
10 the SMTP transport has a message to deliver. In addition, address processor 210 may store a list of addresses in message store 215 that the SMTP transport should deliver to.

At block 440, a flag is set indicating that a message is addressed to an SMS address. In addition, the address may also be placed in an SMS list such that
15 when an SMS transport asks for the next address to deliver the message to, the address may be quickly retrieved and sent to the SMS transport. For example, referring to FIGURE 2, address processor 210 determines that the message is addressed to an SMS recipient and sets a flag indicating that the SMS transport has a message to deliver. In addition, address processor 210 may store a list of addresses in message store 215 that the SMS transport should deliver.

At block 445, a flag is set indicating that a message is addressed to a non-SMTP address. In addition, the address may also be placed in a list such that when
20 the appropriate transport asks for the next address to deliver the message to, the address may be quickly retrieved and sent to the requesting transport. For example, referring to FIGURE 2, address processor 210 determines that the message is addressed to a fax
25 recipient and sets a flag indicating that the fax transport has a message to deliver. In addition, address processor 210 may store a list of addresses in message store 215 that the fax transport should deliver.

At block 435, addresses have been processed and flags set indicating which transports have messages to deliver. At this point, notifications are sent to the
30 transports to indicate that a new message is ready for delivery. In one embodiment of

the invention, notifications are sent to all transports that a message is ready to be delivered. Each transport then queries the message store to determine if the message needs to be delivered by the particular transport. In another embodiment of the invention, notifications are sent only to those transports for which flags have been set
5 indicating that a message has one or more recipients serviced by the transport.

At block 450, processing ends. Next, each transport begins processing to determine whether it has messages to send as described in conjunction with FIGURE 5.

FIGURE 5 is a logical flow diagram illustrating a process for determining if a transport has one or more recipients to deliver a message to and
10 sending the message if so determined, according to one embodiment of the invention. The process starts at block 505 after notification has been sent that a message is available for delivery. It should be noted that the process illustrated may be performed by each transport in the system, either simultaneously or at random intervals.

At block 510, the transport determines if a flag indicating that there are
15 any messages pending that the transport should deliver. This may be accomplished by retrieving a register previously set by an address processor, such as address processor 210 of FIGURE 2, with each bit corresponding to a separate transport. Alternatively, a message store, such as message store 215 of FIGURE 2, could be queried to determine if any messages are pending for the transport to deliver. If no messages are pending,
20 processing follows the no branch to block 545 and ends. If messages are pending, processing follows the yes branch to block 515. For example, referring to FIGURE 2, transport 220, which may be the transport for SMS, determines that a flag has been set indicating that it has messages to deliver.

At block 515, the transport enters a loop in which it queries the message
25 store to determine if any recipients remain to deliver the message to. When all messages have been delivered, the no branch is followed to block 530. When more messages are available, the yes branch is followed to block 520.

At block 520, the transport requests the address of the recipient to deliver the message to. Typically, the transport does so by querying the message store for the

next recipient. For example, referring to FIGURE 2, transport 220 requests the next recipient and receives +14254444233.

At block 525, the transport sends the message to the recipient associated with the address previously requested. The transport may send the message over a cellular/pager network or a WAN/LAN, depending on the nature of the transport. For example, referring to FIGURE 2, if transport 220 is an SMS transport, it may send the message to a pager with telephone number 1-425-444-4233. The message may be as illustrated in FIGURE 3.

At block 530, the transport requests that the flag indicating that it has messages to deliver be cleared. Block 530 is entered after all recipients associated with the transport have been processed. The transport may request that the flag be cleared in a register or memory, by locking the register or memory and clearing the flag in the register or memory. For example, referring to FIGURE 2, transport 220 sends the message to the last SMS recipient, locks memory, and clears the flag.

At block 535, the transport determines if it just cleared the last flag. One of the transports delivering messages will be the last to send the message to a recipient. When the last transport has delivered the message, it may be desired to perform some post-processing on the message, such as to move the message to another folder, such as a sent items or a deleted items folder, or take other appropriate action. When the flags associated with the transports are stored in a register, one way of determining if all flags have been cleared is to compare the register to zero. If the register equals zero, no more flags remain and hence all transports have delivered (or attempted to deliver) messages to all of their associated recipients. When the transport determines that it just cleared the last flag, the yes branch is followed to block 540; otherwise, the no branch is followed to block 545 and processing ends.

At block 540, some post-processing may be performed on the message. For instance, if the message has been completely sent, it may be desirable to move the message from an out box folder to some other folder, such as a sent items folder or the like. For example, referring to FIGURE 2, transport 220 determines that it just cleared

the last flag and requests that the message be moved to a sent items folder. Such status is updated in message store 215 appropriately.

At block 545, processing ends. At this point a message has been received by an input component, such as input component 305, flags associated with transports have been set to indicate which transports should send the message, the transport of FIGURE 5 has sent the message to any recipients that were listed for that transport, has cleared the flag, and performed any post-processing. When each transport in the system has executed the process shown in FIGURE 5, the message has been moved, deleted, or otherwise appropriately handled and flags indicate that sending has been accomplished.

Illustrative Mobile Computing Device

FIGURE 6 is a functional block diagram illustrating functional components of a mobile computing device 600. The mobile computing device 600 has a processor 660, a memory 662, a display 628, and a keypad 632. The memory 662 generally includes both volatile memory (*e.g.*, RAM) and non-volatile memory (*e.g.*, ROM, Flash Memory, or the like). The mobile computing device 600 includes an operating system 664, such as the Windows CE operating system from Microsoft Corporation or other operating system, which is resident in the memory 662 and executes on the processor 660. The keypad 632 may be a push button numeric dialing pad (such as on a typical telephone), a multi-key keyboard (such as a conventional keyboard). The display 628 may be a liquid crystal display, or any other type of display commonly used in mobile computing devices. The display 628 may be touch sensitive, and would then also act as an input device.

One or more application programs 667 are loaded into memory 662 and run on the operating system 664. Examples of application programs include phone dialer programs, email programs, scheduling programs, PIM (personal information management) programs, word processing programs, spreadsheet programs, Internet browser programs, and so forth. The mobile computing device 600 also includes non-volatile storage 668 within the memory 662. The non-volatile storage 668 may be used

to store persistent information which should not be lost if the mobile computing device 600 is powered down. The applications 667 may use and store information in the storage 668, such as e-mail or other messages used by an e-mail application, contact information used by a PIM, appointment information used by a scheduling program, documents used by a word processing application, and the like. A synchronization application also resides on the mobile device and is programmed to interact with a corresponding synchronization application resident on a host computer to keep the information stored in the storage 668 synchronized with corresponding information stored at the host computer.

10 The mobile computing device 600 has a power supply 670, which may be implemented as one or more batteries. The power supply 670 might further include an external power source, such as an AC adapter or a powered docking cradle, that supplements or recharges the batteries.

15 The mobile computing device 600 is also shown with two types of external notification mechanisms: an LED 640 and an audio interface 674. These devices may be directly coupled to the power supply 670 so that when activated, they remain on for a duration dictated by the notification mechanism even though the processor 660 and other components might shut down to conserve battery power. The LED 640 may be programmed to remain on indefinitely until the user takes action to indicate the powered-on status of the device. The audio interface 674 is used to provide audible signals to and receive audible signals from the user. For example, the audio interface 674 may be coupled to a speaker for providing audible output and to a microphone for receiving audible input, such as to facilitate a telephone conversation.

25 The mobile computing device 600 also includes a radio 672 that performs the function of transmitting and receiving radio frequency communications. The radio 672 facilitates wireless connectivity between the mobile computing device 600 and the outside world, via a communications carrier or service provider. Transmissions to and from the radio 672 are conducted under control of the operating system 664. In other words, communications received by the radio interface layer 672

may be disseminated to application programs 667 via the operating system 664, and vice versa.

Illustrative Computing Device

5 With reference to FIGURE 7 an exemplary system for implementing the invention includes a computing device, such as computing device 700. In a very basic configuration, computing device 700 typically includes at least one processing unit 702 and system memory 704. Processing unit 702 includes existing physical processors, those in design, multiple processors acting together, virtual processors, and any other
10 device or software program capable of interpreting binary executable instructions. Depending on the exact configuration and type of computing device, system memory 704 may be volatile (such as RAM), non-volatile (such as ROM, flash memory, etc.) or some combination of the two. System memory 704 typically includes an operating system 705, one or more program modules 706, and may include program
15 data 707. This basic configuration is illustrated in FIGURE 7 by those components within dashed line 708.

 Computing device 700 may also have additional features or functionality. For example, computing device 700 may also include additional data storage devices (removable and/or non-removable) such as, for example, magnetic
20 disks, optical disks, or tape. Such additional storage is illustrated in FIGURE 7 by removable storage 709 and non-removable storage 710. Computer storage media may include volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information, such as computer readable instructions, data structures, program modules or other data. System memory 704,
25 removable storage 709 and non-removable storage 710 are all examples of computer storage media. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to
30 store the desired information and which can be accessed by computing device 700. Any

such computer storage media may be part of device 700. Computing device 700 may also have input device(s) 712 such as keyboard, mouse, pen, voice input device, touch input device, etc. Output device(s) 714 such as a display, speakers, printer, etc. may also be included. All these devices are known in the art and need not be discussed at length here.

Computing device 700 may also contain communications connection(s) 716 that allow the device to communicate with other computing devices 718, such as over a network. Communications connection(s) 716 is an example of communication media. Communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport and includes any information delivery media. The term “modulated data signal” means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. The term computer readable media as used herein includes both storage media and communication media.

The various embodiments of the invention are implemented as a sequence of computer implemented steps or program modules running on a computing system and/or as interconnected machine logic circuits or circuit modules within the computing system. The implementation is a matter of choice dependent on the performance requirements of the computing system implementing the invention. In light of this disclosure, it will be recognized by one skilled in the art that the functions and operation of the various embodiments disclosed may be implemented in software, in firmware, in special purpose digital logic, or any combination thereof without deviating from the spirit and scope of the present invention as recited within the claims attached hereto.

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many

embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000